

Burnett (C. H.)

A CONTRIBUTION
TO THE
COMPARATIVE DISTRIBUTION
OF
BLOODVESSELS
IN THE
MEMBRANA TYMPANI.

By CHARLES H. BURNETT, M.D.,
Aural Surgeon to the Philadelphia Dispensary, and to the Presbyterian
Hospital in Philadelphia.

Reprinted from the American Journal of the Medical Sciences, Jan. 1873.

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IN a series of investigations upon the membrana tympani of the mammalia, I have found in the dog, the cat, the goat, and the rabbit, an arrangement of the bloodvessels not heretofore described, and totally different from that in man.

Prussak,¹ in his brochure upon the circulation of the blood in the tympanum of the dog, has represented the general topography of the vascular system in the membrana tympani of that animal, but he does not point out the ultimate *loop-like* arrangement

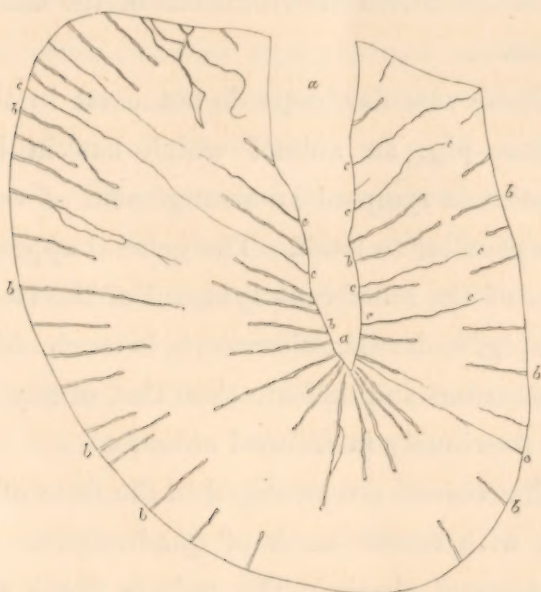
¹ Verhandlungen der Königlich Saechsischen Gesellschaft der Wissenschaften zu Leipsic, 1868.

of the vessels distributed over the surface of the membrane. The plate which accompanies his article seems to indicate that the delicate vascular loops have been broken by the force of injection, and thus escaped the eye of the observer.

In my investigations I have found that from the periphery of the membrane a series of vessels run directly towards the manubrium of the malleus; then each vessel, at a point from one-half to one-third of the distance between the periphery of the membrane and the manubrium of the malleus, turns *abruptly* upon itself and returns to the periphery, thus forming a series of *vascular loops* at nearly equal distances from each other around the edge of the membrane.

A similar series of loops run both anteriorly and posteriorly from the manubrium of the malleus towards the periphery of the membrana tympani—a diagram of which may be seen in the accompanying wood-cut,

representing the membrana tympani of a dog magnified eight diameters.



Membrana tympani of dog. The wood-cut is from a drawing by Heitzman, of Vienna, of a gold preparation made by and in the possession of the author: *a, a*, Vacancy left by manubrium of malleus; *b, b, b, b*, Vascular loops; *c, c*, Ordinary capillaries.

This arrangement of vessels in the membrana tympani is constant in the dog, the cat, the goat, and the rabbit, in consequence of which a portion of the membrane between the annulus tympanicus and the manubrium of the malleus remains free from capillaries

in its normal condition, and ordinary disturbances in the circulation are less likely to interfere with the vibrations of the membrane.

These vascular loops do not exist in the Guinea-pig, an animal which has in its membrana tympani an arrangement of vessels peculiar to itself. The general appearance of the membrana tympani of the Guinea-pig, under the microscope, is much more transparent and delicate than that of any of the previously mentioned animals.

The vessels are arranged in the form of a net, with coarse mesh of quadrangular or pentagonal shape. The radiate fibres are strongly developed in comparison with the circular fibres, which are sparsely distributed throughout the texture of the membrane. They are, however, readily seen, and present an appearance as peculiar to the membrana tympani of the Guinea-pig, as the shape of the mesh of the network of bloodvessels. In no other membrane have I seen as dis-

tinctly the blood-corpuscles lying within the capillaries as in that of the Guinea-pig.

The membranes which show these loops and other vascular arrangements most distinctly are such as have been colored with a solution of the chloride of gold ($\frac{1}{2}$ per cent.). The vascular arrangement can be seen, but not very satisfactorily, in membranes which have been treated with osmic acid or a solution of carmine. The best specimens, showing not only bloodvessels, but in many cases the delicate nerves of the membrane, I have obtained by preparing the membrana tympani of the dog in the following manner: Remove the membrane from the animal as soon as possible after death. (In the majority of my experiments the animal had been dead but a few minutes.) Steep the membrane a few seconds in concentrated acetic acid; then lay it in a solution of chloride of gold, which should be kept at a temperature somewhat above that of the blood, for one-half hour. After this

treatment, the membrane should remain twenty-four hours in glycerine, or water slightly acidulated with acetic acid, and exposed to the light till it assumes a delicate purple hue. The older the preparation becomes, the more distinctly are the vessels colored. I have some preparations, mounted in glycerine, now almost a year old, which are better than the day they were made—since the gold has taken an increasing hold upon the tissues of the vessels and nerves. After a number of trials, I prefer leaving the membrane in glycerine acidulated with acetic acid, since it demands less care in respect to renewal, and I am never chagrined at finding my specimen destroyed by the evaporation of the water.

By this process the *loops*, and the nerves accompanying them, are most likely to be rendered visible.

The arrangement of the nerves, not represented in the wood-cut, is best described as “fork-shaped.” The prongs embrace the

loop: the handle unites with a similar projection from the opposite series of loops. As a rule, the vessels color more readily under the action of chloride of gold, than the nerves.

How this might be in clear weather, I am not prepared to say, as all of my experiments were performed in the cloudy weather of a Vienna winter, notwithstanding which, the nerves frequently became richly colored.

This method of coloring vessels and nerves I have applied only to the *membrana tympani*, and hence, I can claim no superiority for it in connection with other tissues. When it succeeds, it is superior to any injection of this very delicate membrane, since the vessels and nerves are rendered visible with a distinctness characteristic of the action of chloride of gold, a reaction to which our attention was first called by Cohnheim.

The bloodvessels are rendered distinct, without becoming opaque, so perfectly in

most cases that we can detect the blood corpuscles lying within the capillary.

The vessel, furthermore, retains its normal calibre and position, whereas, when we resort to injections, the vessels are apt to be unduly distended, are necessarily opaque, extravasation of coloring matter may take place, or the vessel may be ruptured.

The method is more convenient than injection, and as no mechanical force is used, the field of the microscope must of necessity present a very true picture of the tissues as they are in their normal state.

The application of this method of coloring to the membrana tympani of man shows the *absence* of the vascular loops already described, and reveals an arrangement of the vessels similar to that obtained by other observers with injections.

The arrangement of the vessels is not unlike the vascular network in the membrana tympani of the Guinea-pig. In man, how-

ever, the mesh is much finer, the vessels coarser. The fibrous layer is, on the other hand, very thick, and is more equally composed of radiate and circular fibres than the membrane in the Guinea-pig.

Since the membrana tympani of man is supplied by a dense network of vessels, the gold method of coloring it is superior to the usual method by injection, as the entire preparation is less opaque than when the vessels are filled with Prussian blue, carmine, etc.

We may, therefore, conclude that:—

1. There is a distribution of vessels in the membrana tympani of man peculiar to him.

2. There is a distribution of vessels in the membrana tympani of the dog, the cat, the goat, and the rabbit, constant in, as well as peculiar to them.

3. A distribution of bloodvessels exists in the membrana tympani of the Guinea-pig peculiar to it.

